PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-246808
(43)Date of publication of application : 30.08.2002

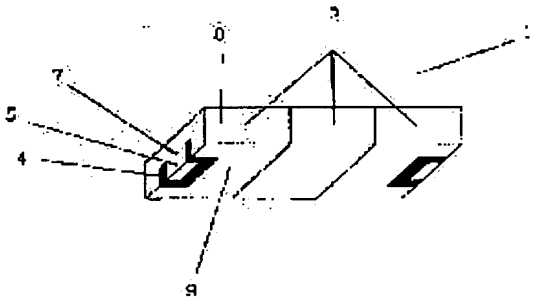
(51)Int.CI. H01P 1/208
H01P 1/212
H01P 5/08

(21)Application number : 2001-046034
(22)Date of filing : 22.02.2001

(71)Applicant : UBE IND LTD
(72)Inventor : KAWAMURA KOICHI
OYAMA TAKAHARU

(54) DIELECTRIC FILTER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a dielectric filter equipped with input and output electrodes having efficient input and output coupling capable of making excellent substrate mountability, adjusting its matching with an outer circuit after mounting, reducing the leakage of electromagnetic waves, and reducing a loss.
SOLUTION: In this TE mode dielectric filter having an input and output electrode constituting part, a gland electrode, and a connecting part in which a plurality of dielectrics are serially connected, the input and output electrode constituting part is constituted of input and output electrodes and dielectric exposing parts connected to them, and formed on the dialectics at the both edges of the dielectric filter, and the input and output electrode constituting part and the input and output electrodes are continuously formed on the mounting faces of the dielectrics and one side face other than the joint face, and only the upper edges of the input and output electrodes on the side faces are short-circuited to the ground electrode.



LEGAL STATUS

[Date of request for examination] 12.02.2004

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] It is the TE-mode dielectric filter which two or more dielectrics join to a serial, and has the I/O electrode configuration section, a grand electrode, and a bond part. Said I/O electrode configuration section consists of a dielectric outcrop which touches an I/O electrode and this I/O electrode. And said I/O electrode configuration section is formed on the dielectric of the both ends of said dielectric filter. Said bond part is formed in the plane of composition of dielectrics, and said grand electrode is formed in the dielectric front face except said I/O electrode configuration section and said bond part. Said I/O electrode configuration section and said I/O electrode are a dielectric filter characterized by being continuously applied and formed in the component side of said dielectric, and one side face except said plane of composition, and only the upper limit of the I/O electrode of said side face having connected with said grand electrode too hastily.
[Claim 2] The dielectric filter according to claim 1 characterized by forming the too hastily connecting point of said I/O electrode and said grand electrode in a location lower than the upper limit of said dielectric side face.
[Claim 3] The dielectric filter according to claim 1 or 2 characterized by connecting electrically the substrate signal line which laid said dielectric filter on the insulator substrate, and was formed on said insulator substrate, and the electrode section formed in the component side of the I/O electrode of said dielectric filter.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the small dielectric filter which joined two or more dielectrics suitable for use with a 5 to 30GHz high frequency band.
[0002]
[Description of the Prior Art] The mobile communication system of a frequency band higher than 2GHz is examined with rapid development of information and communication fields. In old mobile communications, the frequency to 2GHz band extent is used, and what combined the dielectric coaxial resonator as a filter used for a mobile station was mainly used.
[0003] However, when using on the frequency of 5GHz or more, if it is going to secure high Q, it is difficult [it / it is difficult to consider as the filter of low loss in this dielectric coaxial resonator, and] to make an appearance small.
[0004] The dielectric filter which connected the dielectric using the TE mode as shown in practical drawing 10 also in a frequency band 3GHz or more from these things to two or more serials is proposed. Drawing 10 (a) is the perspective view, and drawing 10 (b) is a decomposition perspective view. two or more TE-mode dielectric resonators 20 -- respectively -- the front face of the dielectric of a rectangular parallelepiped -- a conductor -- metallizing is given and the coupling holes 22 which removed metallizing and were formed for association, such as circular or a rectangle, are formed on the field joined to other resonators. Moreover, on the field combined with an input/output terminal, the I/O electrode 26 which removed surrounding metallizing and was formed is formed. These three dielectric resonators 20 are unified by contacting and soldering a plane of union, as shown in drawing 10 (a).
[0005] On the exfoliation band formed in the side face, the upper limit of an electrode flows through the I/O electrode 26 prepared in the both ends of a dielectric filter on a metal coat on top, and as there is a lower limit of an electrode in the middle of an exfoliation band, it is formed. And the metal drawer electrode 24 of a L character configuration is attached in this I/O electrode 26 by soldering etc. A dielectric filter is combined with an external circuit through this drawer electrode 24.
[0006]
[Problem(s) to be Solved by the Invention] However, in this filter, connection between an I/O electrode and an external circuit is made through the metallic ornaments which are metal drawer electrodes. For this reason, while the components mark for external connection increase, we are anxious about adjustment (VSWR) with an external circuit varying by dispersion in this metallic-ornaments connection. Moreover, when it mounts a dielectric filter in a substrate, adjustment with the external circuit after mounting is required, and it is important as a dielectric filter for the adjustment to be also easy.
[0007] Furthermore, as a dielectric filter of a RF, leak of an electromagnetic wave is lessened, I/O association is performed efficiently, and it is anxious for it being low loss.
[0008] It is offering the dielectric filter equipped with the I/O electrode which has efficient I/O association which this invention's was made in view of the above-mentioned trouble, and the purpose of this invention excelled [association] in substrate mounting nature, and could adjust adjustment with an external circuit after mounting, and made leak of an electromagnetic wave small, and made loss small.
[0009]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, two or more dielectrics join this invention to a serial. It is the TE-mode dielectric filter which has the I/O electrode configuration section, a grand electrode, and a bond part. Said I/O electrode configuration section consists of a dielectric outcrop which touches an I/O electrode and this I/O electrode. And said I/O electrode configuration section

is formed on the dielectric of the both ends of said dielectric filter. Said bond part is formed in the plane of composition of dielectrics, and said grand electrode is formed in the dielectric front face except said I/O electrode configuration section and said bond part. It is continuously formed in the component side of said dielectric, and one side face except said plane of composition, covering said I/O electrode configuration section and said I/O electrode, and the dielectric filter characterized by only the upper limit of the I/O electrode of said side face having connected with said grand electrode too hastily is offered.
[0010] Furthermore, it is desirable that the too hastily connecting point of said I/O electrode and said grand electrode is formed in a location lower than the upper limit of said dielectric side face.
[0011] Moreover, this invention lays said dielectric filter on an insulator substrate, and connects electrically the substrate signal line formed on said insulator substrate, and the electrode section formed in the component side of the I/O electrode of said dielectric filter.
[0012]
[Embodiment of the Invention] It is the TE-mode dielectric filter which two or more dielectrics joined to the serial in this invention. By considering as the structure through which covered over which and formed the I/O electrode in the component side from one side face of a dielectric at the dielectric of the both ends of said dielectric filter, and the upper limit of an I/O electrode flowed in the grand electrode on said dielectric side face Like before, metallic ornaments special to connection with an external circuit are not needed, but a dielectric filter can be easily mounted in a substrate, and adjustment (VSWR) with an external circuit cannot vary easily. Moreover, adjustment with the external circuit after mounting can also be easily performed by deleting the side-face part of an I/O electrode. Furthermore, by field association in the dielectric side face of an I/O electrode, and electric-field association by the component side, I/O association can be performed efficiently, area of a dielectric outcrop can be made small, and it can consider as the small low loss filter of leak of an electromagnetic wave. By setting up the too hastily connecting point of an I/O electrode and a grand electrode below the upper limit of the side face of a dielectric especially, area of a dielectric outcrop can be further made small and it can consider as the filter of low loss.
[0013] Hereafter, the operation gestalt of the dielectric filter concerning this invention is explained with reference to an accompanying drawing. In each operation gestalt, the same sign was given to the same components and the same part.
[0014] Drawing 1 is the perspective view of 1 operation gestalt of the dielectric filter concerning this invention, and, in drawing 1 (a), drawing 1 R> 1 (b) shows the decomposition perspective view before an assembly after an assembly. The dielectric filter 1 concerning this invention is formed in the form where two or more resonators of the dielectric 2 with the predetermined dimension committed as a TE-mode resonator were connected. two or more TE-mode dielectric resonators -- respectively -- the front face of the dielectric 2 of a rectangular parallelepiped -- a conductor -- metallizing is given and the coupling holes 3 which consist of a non-metallizing part as a bond part, such as circular or a rectangle, are formed on the plane of composition joined to other dielectric resonators.
[0015] Moreover, it is continuously formed in the component side 9 of said dielectric, and one side face except said plane of composition, applying the I/O electrode configuration section 6 which becomes the dielectric of both ends from the dielectric outcrop 4 which touches the I/O electrode 5 and it, and in the I/O electrode configuration section 6, the I/O electrode 5 follows a component side 9 and said side face, and is formed. The I/O electrode 5 has flowed through the upper limit of the side face of the grand electrode 8 and the dielectric 2 of both ends as a too hastily connecting point 7. The I/O electrode 5 can also be formed on the side face (however, a plane of composition is removed) of others other than said plane of composition of the dielectric 2 of both ends, and the field of the opposite side.
[0016] It mounts in the substrate which formed the substrate signal line 11 as shown in drawing 8 , and the substrate signal line 11 prepared in component-side 9 part and substrate of the I/O electrode 5 is connected for such a dielectric filter of a configuration with electroconductive glue, such as solder. Thereby, a dielectric filter can be easily mounted in a substrate, without using special components like L character metallic ornaments on the occasion of mounting. Moreover, the substrate grand electrode 12 is formed in the substrate, and the grand electrode 8 of a dielectric filter and the substrate grand electrode 12 on a substrate are connected electrically. The substrate grand electrode 12 may be formed in the rear face of a substrate, and this substrate grand electrode 12 and the grand electrode 8 of a dielectric filter are electrically connected in that case through the through hole established in the substrate, or the side face of a substrate. Moreover, adjustment of association (VSWR) of I/O is possible for after mounting by shaving a part of I/O electrode of a dielectric side face. Furthermore, while making the exposure product of a ceramic small and being able to perform leak of an electromagnetic wave few compared with the I/O electrode 5 of the shape of an island

which does not have the too hastily connecting point 7 which is illustrated by drawing 6 , field association by the electrode of a dielectric side face and electric-field association by the electrode of a component side can be used efficiently, and loss can be pressed down small.
[0017] The perspective view of other 1 operation gestalten of the dielectric filter applied to this invention at drawing 3 is shown. Except the pattern of an I/O electrode, it is the same configuration as the dielectric filter shown in drawing 1 . A different point from the operation gestalt of drawing 1 is that there is a too hastily connecting point 7 of the I/O electrode 5 and the grand electrode 8 caudad from the upper limit of the side face of a dielectric block. It becomes possible to be able to reduce further by this the area of the dielectric outcrop 4 currently formed in the side face, consequently to press down loss of a filter small further. Consequently, it is also possible to become possible to make large area of the exfoliation part for association during a dielectric block, and to consider as the filter of a wide band.
[0018]
[Example] (Example 1) The dielectric filter which is one of the operation gestalten of this invention as shown in drawing 1 was produced as follows, and the property of a filter was measured.
[0019] This example is the three-step filter of the configuration of 6.00x17.7x3mmt. Dimension processing of the dielectric block of 6.00x6.00x3.00mmt is carried out at the frequency which forms a filter, as follows, an electrode is formed so that a bond part, the I/O electrode configuration section, and a grand electrode may be constituted, and it was made to become a TE-mode resonator. The I/O electrode configuration section 6 of 3.0mm width of face was set up in the center on a side face between the side-face vertical edges of the resonator of both ends, and the I/O electrode 5 of 1.5mm Rhine width of face was formed in the I/O electrode configuration section 6. Moreover, the I/O electrode 5 of 1.0mm width-of-face x1.0mm depth was formed at the component side in the I/O electrode configuration section 6 of 2.4mm width-of-face x2.0mm depth. Thus, the dielectric outcrop 4 was formed in fields other than I/O electrode 5 in the I/O electrode configuration section 6 except for the upper limit of the I/O electrode 5. Moreover, the dielectric outcrop of 1.2mm width-of-face x3mm height was prepared in the center as a bond part between the vertical edges of the plane of composition of a resonator for association between resonators. The grand electrode was formed in front faces other than said I/O electrode configuration section 6 of a dielectric filter, and said bond part. Finally, these resonators were joined with electroconductive glue, such as solder. Specific-inductive-capacity epsilonr of the used dielectric materials is 37.
[0020] The property of the filter produced to drawing 2 is shown. The dielectric filter of the insertion loss whose insertion loss of a peak point is 1.51dB with small center frequency at 5550MHz 3dB bandwidth was obtained by 150MHz.
[0021] In spite of having prepared the I/O electrode also in the filter component side, and having made mounting nature to a substrate easy and having enabled fine tuning after mounting with the electrode of a side face, that the dielectric filter of low loss has been constituted Since the pattern of an I/O electrode was carried out like this invention and the area of a dielectric outcrop was pressed down small, it is considered because field association by the electrode of a side face and electric-field association by the electrode of a component side worked efficiently.
[0022] Drawing 4 is an example of an experiment which shows that unloaded Q (Qu value) becomes large and loss becomes small by making the exposure product of a dielectric small. drawing in which drawing 4 (a) shows the measuring method of the unloaded Q (Qu value) of a dielectric resonator -- it is -- a conductor -- the sample in which the dielectric outcrop was formed was installed in the side face on the plate, frequency characteristics were measured having installed the coaxial cable which formed the loop antenna at the both sides of a sample, and having bet the RF, and the unloaded Q on appearance (Qu value) was computed.
[0023] Samples are what exfoliated the electrode of the side face of the 5.85x5.85x3.0mm TE-mode resonator of a 5GHz band in the center section in the field of 1.5mm width-of-face x1.0mm height (drawing 4 (b)), and the thing (drawing 4 (d)) which exfoliated the electrode of the side face of an isomorphism-like resonator in the center section in the field of 1.5mm width-of-face x3.0mm height. The change and loss of resonance frequency by electromagnetic wave leak of each sample are shown in drawing 4 (c) and drawing 4 (e).
[0024] To resonance frequency being 5712MHz when the electrode of the side face of the 5.85x5.85x3.0mm TE-mode resonator of a 5GHz band is exfoliated in the center section in the field of 1.5mm width-of-face x1.0mm height, when it exfoliates in the field of 1.5mm width-of-face x3.0mm height, it is set to 5631MHz and falls by about 81MHz, and at this time, Qu value deteriorates with 1050 to about 650, and increase of loss by leak of an electromagnetic wave takes place. By seeing, Q of a dielectric proper and Q resulting

from an electrode configuration which were measured are acting, since the thing same as dielectric materials is used in this experiment, it considers that Q of a dielectric proper is the same, and the difference of the above-mentioned measured value originates in a dielectric exposure product, and the upper unloaded Q (Qu value) shows that an insertion loss is so large that a dielectric outcrop is large.

[0025] (Example 2) In order to lessen leak of an electromagnetic wave further, as shown in drawing 3 , the example of the dielectric filter which set the too hastily connecting point of an I/O electrode and a grand electrode as the location lower than the upper limit of a side face is shown. In this example, the location of said too hastily connecting point was made into one third of the height of a dielectric side face, and the three-step filter of the magnitude of 5.85x17.7x3mmt was produced. Dimension processing of the dielectric block of 5.85x5.85x3mmt was carried out at the frequency which forms a filter, and an electrode is formed and it was made to become a TE-mode resonator as follows, so that a bond part, the I/O electrode configuration section, and the grand polar zone may be constituted. The I/O electrode configuration section 6 of 3.3mm width-of-face x1.0mm height was set as the side face of the resonator of both ends from the side-face lower limit, and the electrode of Rhine of 1.5mm width of face was formed in the I/O electrode configuration section 6. Moreover, the dimension formed the I/O electrode 5 of 1.5mm width-of-face x1.5mm depth at the component side in the I/O electrode configuration section 6 of 2.4mm width-of-face x2.0mm depth. Thus, the dielectric outcrop 4 was formed in fields other than I/O electrode 5 in the I/O electrode configuration section 6 except for the upper limit of the I/O electrode 5 of a side face. Moreover, it prepared in the center between the vertical edges of the plane of composition of a resonator for association between resonators by making the exfoliation band of 1.5mm width-of-face x3mm height into a bond part 3. The grand electrode was formed in front faces other than said I/O electrode configuration section 6 of a dielectric filter, and said bond part 3. Finally these resonators were joined with electroconductive glue, such as solder. Specific-inductive-capacity epsilonr of the used dielectric materials is 37.

[0026] The property of the dielectric filter which carried out in this way and was produced to drawing 5 is shown. By 5700MHz, 3dB bandwidth was obtained for center frequency, and the insertion loss of a peak point was acquired for the 0.97dB thing by 230MHz. [0027] (Example 1 of a comparison) The dielectric filter of a gestalt with the pattern of the I/O electrode 5 of the shape of an island without a too hastily connecting point with a grand electrode as shown to drawing 6 that the dielectric outcrop 4 of the I/O electrode configuration section of the dielectric filter of an example 2 serves as the same area for a comparison was formed.

[0028] This example of a comparison is the three-step filter of the magnitude of 5.85x17.7x3mmt. Dimension processing of the dielectric block of 5.85x5.85x3mmt was carried out at the frequency which forms a filter, and an electrode is formed and it was made to become a TE-mode resonator as follows, so that a bond part, the I/O electrode configuration section, and the grand polar zone may be constituted. The I/O electrode configuration section 6 of 3.3mm width-of-face x1.0mm height was set as one side face of the resonator of both ends from the side-face lower limit, and the I/O electrode 5 of 2.0mm width-of-face x0.75mm height was formed in the I/O electrode configuration section 6. Moreover, the dimension formed the I/O electrode 5 of 1.5mm width-of-face x1.5mm depth at the component side in the I/O electrode configuration section 6 of 2.4mm width-of-face x2.0mm depth. The dielectric outcrop (bond part 3) of 1.0mm width-of-face x3mm height was prepared in the center between the vertical edges of the plane of union of a resonator for association between resonators. The grand electrode was formed in front faces other than said I/O electrode configuration section 6 of a dielectric filter, and said bond part 3. As for the area of the dielectric outcrop of a plane of composition, the I/O impedance of the whole dielectric filter is determined are set to 50 ohms. Finally these resonators were joined with electroconductive glue, such as solder. Specific-inductive-capacity epsilonr of the used dielectric materials is 37.

[0029] The property of the dielectric filter of the gestalt of drawing 6 is shown in drawing 7 . That whose insertion loss of a peak point 3dB bandwidth is 2.06dB in 5710MHz for center frequency was obtained by 100MHz.

[0030] Compared with the I/O electrode structure which does not have the too hastily connecting point 7 in I/O electrode structure which has the too hastily connecting point 7 with a grand electrode in a side face, and the I/O electrode structure in the location where said too hastily connecting point 7 is lower than the upper limit of a dielectric side face, I/O association is large especially, and a dielectric filter with wide fractional band width can be obtained so that the comparison with an example 2 and the example 1 of a comparison may show.

[0031] That is, when the area of the dielectric outcrop of the I/O electrode configuration section is the same, the electrode structure of this invention has a small I/O impedance, since area of a bond part 3 can be

enlarged, can have large fractional band width, therefore can make an insertion loss small. Moreover, when it constitutes so that area of a bond part 3 may be made the same, area of the dielectric outcrop 4 of the electrode structure of this invention can be made still smaller, and an insertion loss can be made still smaller.

[0032] (Example 3) The I/O electrode of the component side of the RF dielectric filter of this invention is mounted in a substrate at drawing 8 , and the example electrically connected with the drawer electrode formed by the substrate is shown. Drawing 8 R> 8 (a) is drawing showing 1 operation gestalt which mounted the dielectric filter in the substrate, and drawing 8 (b) is drawing showing separately the substrate signal line 11, the substrate 10 with which the substrate grand electrode 12 was formed, and a dielectric filter. Using the Teflon (trademark) substrate of 10x20x0.4mmt, as shown on it at drawing 8 (b), the substrate signal line 11 of 1.17mm width of face used as the drawer electrode which connects with the I/O electrode of a dielectric filter and is tied to an external circuit, and the substrate grand electrode 12 tied to the grand electrode of a dielectric filter are formed in a substrate 10. Three steps of dielectric filters of a 22GHz band were mounted on the substrate 10 by applying paste-like solder on a substrate, placing a dielectric filter on it, and pasting up electrically the substrate signal line 11 of the I/O electrode of the component side of a dielectric filter, and a substrate with solder using a reflow furnace.
[0033] The dielectric filter used for this example is a three-step filter of the magnitude of 3.00x8.88x1.5mmt, and was produced as follows. Dimension processing of the dielectric block of 3.00x3.00x1.5mmt was carried out at the frequency which forms a filter, and an electrode is formed and it was made to become a TE-mode resonator as follows, so that a bond part, the I/O electrode configuration section, and the grand polar zone may be constituted. The I/O electrode configuration section 6 of 1.5mm width-of-face x0.5mm height was set as the side face of the resonator of both ends from the side-face lower limit, and the I/O electrode 5 of Rhine of 0.9mm width of face was formed in the I/O electrode configuration section 6. Moreover, the I/O electrode 5 of 0.9mm width-of-face x0.7mm depth was formed at the component side in the I/O electrode configuration section 6 of 1.4mm width-of-face x1.0mm depth. The dielectric outcrop of 0.68mm width-of-face x0.5mm height was prepared in the center of the plane of composition of a resonator in the center for association between resonators. The grand electrode was formed in front faces other than said I/O electrode configuration section 6 of a dielectric filter, and said bond part. Finally these resonators were joined with electroconductive glue, such as solder. Specific-inductive-capacity epsilonr of the used dielectric materials is 9.6.
[0034] The property of the dielectric filter installed in drawing 9 at the substrate of the gestalt of drawing 8 is shown. The dielectric filter of the input loss whose insertion loss of a peak point is 1.98dB with small center frequency at 22200MHz 3dB bandwidth was obtained by 325MHz.
[0035] Thus, a dielectric filter with little input loss which equipped the substrate with the I/O electrode and substrate signal line by the side of a component side by pasting up with conductive binders, such as solder, can be easily obtained using the dielectric which has the I/O electrode pattern of this invention.
[0036]
[Effect of the Invention] Since the I/O electrode was formed over the 2nd page containing a component side in this invention by the above explanation so that clearly, Since the I/O electrode of a dielectric filter is connectable with the signal line on a substrate with conductive binders, such as solder, not using special metallic ornaments, it excels in mounting nature. When there is no dispersion by metallic-ornaments connection and adjustment (VSWR) with the external circuit after mounting in a substrate also corrects a part of electrode of a side face, it can carry out easily.
[0037] Moreover, in spite of forming the dielectric exposure in the I/O electrode configuration section over such 2nd page, by short-circuiting the end of the I/O electrode of a dielectric side face with a grand electrode, I/O association can be strengthened, leak of an electromagnetic wave can be made small, and a low loss dielectric filter can be obtained. Furthermore, the filter of broadband width of face can also be constituted compared with the I/O electrode of structure without such a too hastily connecting point.

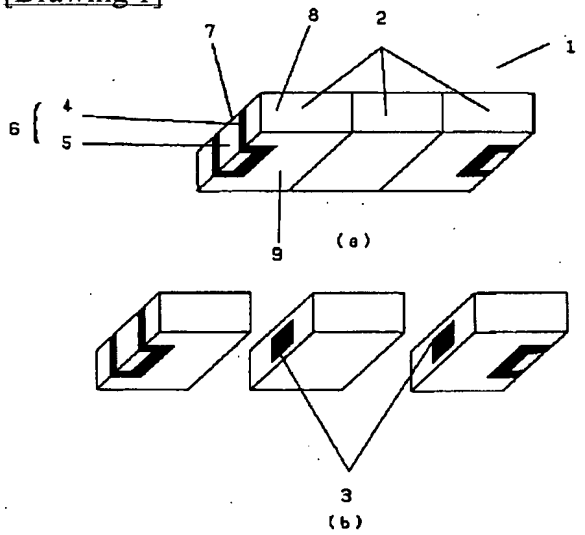
[Translation done.]

* NOTICES *

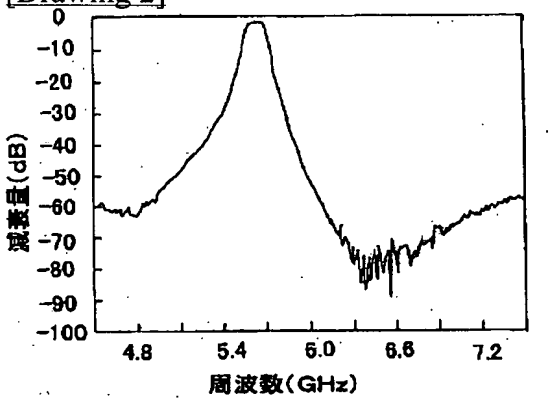
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

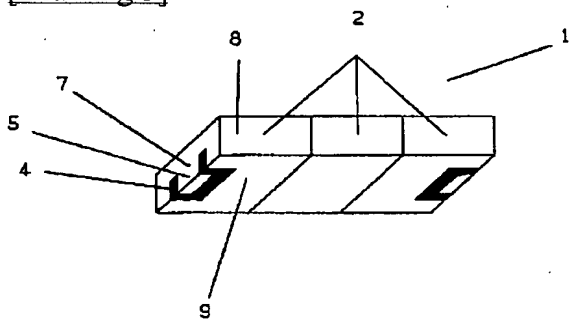
[Drawing 1]



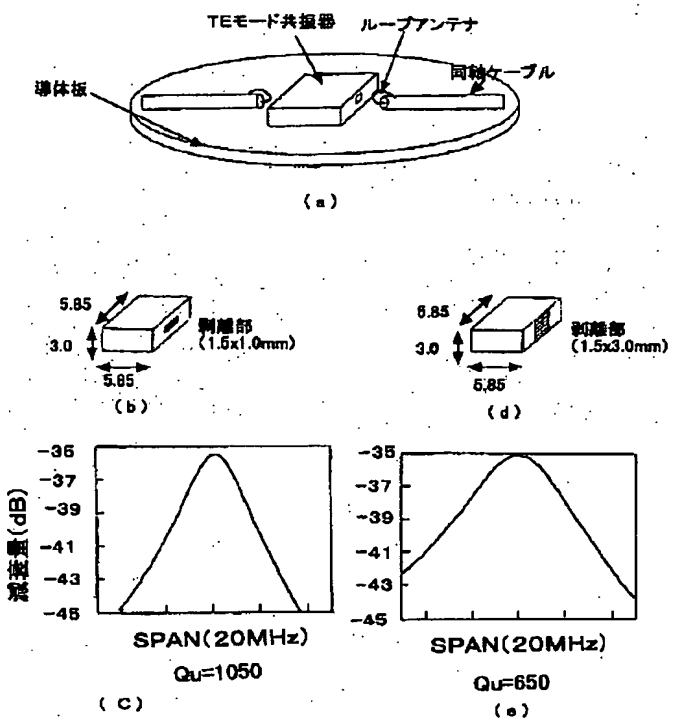
[Drawing 2]



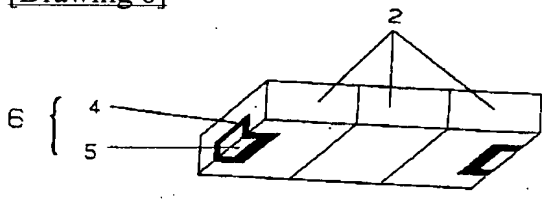
[Drawing 3]



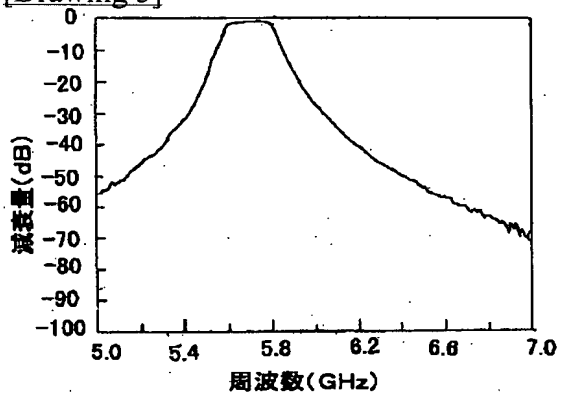
[Drawing 4]



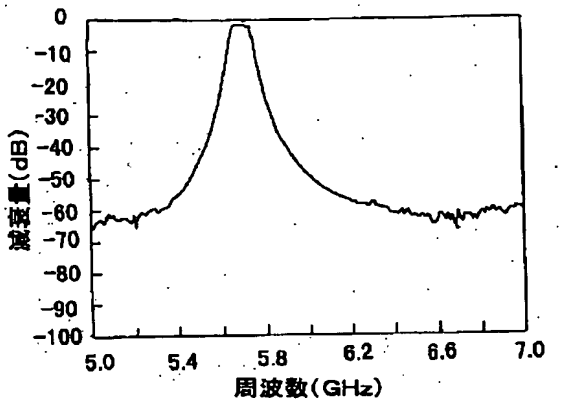
[Drawing 6]



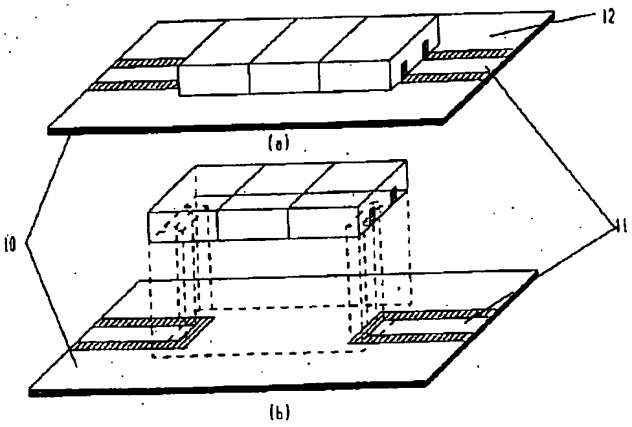
[Drawing 5]



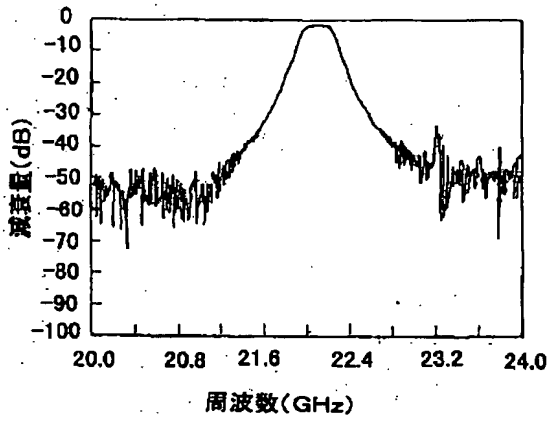
[Drawing 7]



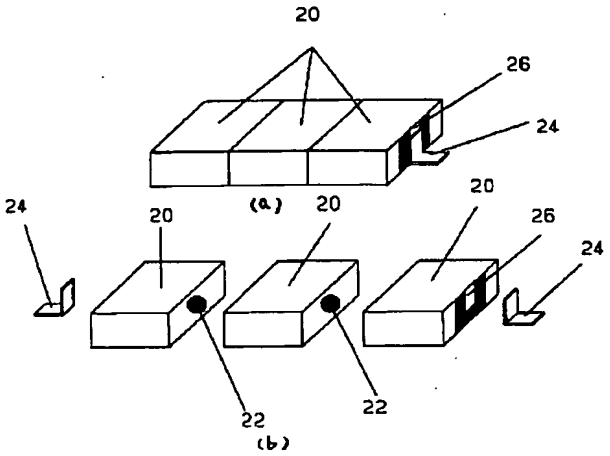
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]